



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:
27.06.2012 Bulletin 2012/26

(51) Int Cl.:
H01L 33/12 (2010.01) **H01S 5/323** (2006.01)
H01L 33/04 (2010.01) **H01L 33/32** (2010.01)

(43) Date of publication A2:
12.01.2011 Bulletin 2011/02

(21) Application number: **10180069.6**

(22) Date of filing: **10.03.1999**

(84) Designated Contracting States:
BE DE ES FI FR GB IT NL

(30) Priority: **12.03.1998 JP 6023398**
25.05.1998 JP 16145298
06.10.1998 JP 28434598
17.11.1998 JP 32628198
08.12.1998 JP 34876298
25.12.1998 JP 36829498
29.01.1999 JP 2304899
29.01.1999 JP 2304999

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
99907886.8 / 1 063 711

(71) Applicant: **Nichia Corporation**
Anan-shi, Tokushima 774-8601 (JP)

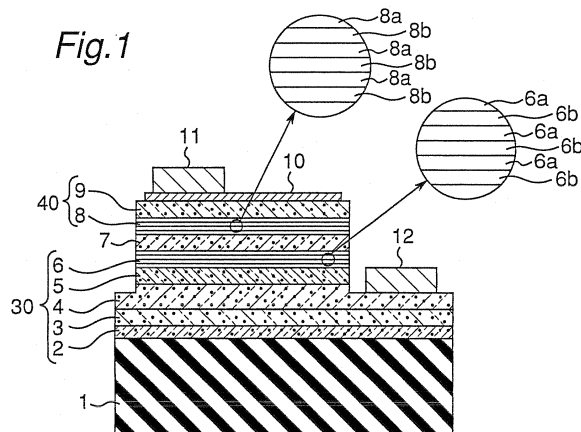
(72) Inventors:
• **Tanizawa, Koji**
Tokushima 774-8601 (JP)
• **Mitani, Tomotsugu**
Tokushima 774-8601 (JP)
• **Nakagawa, Yoshinori**
Tokushima 774-8601 (JP)
• **Takagi, Hironori**
Tokushima 774-8601 (JP)
• **Marui, Hiromitsu**
Tokushima 774-8601 (JP)
• **Fukuda, Yoshikatsu**
Tokushima 774-8601 (JP)
• **Ikegami, Takeshi**
Tokushima 774-8601 (JP)

(74) Representative: **Vossius & Partner**
Siebertstrasse 4
81675 München (DE)

(54) **A nitride semiconductor device**

(57) According to the nitride semiconductor device with the active layer made of the multiple quantum well structure of the present invention, the performance of the multiple quantum well structure can be brought out to intensify the luminous output thereof thereby contributing an expanded application of the nitride semiconductor de-

vice. In the nitride semiconductor device comprises an n-region having a plurality of nitride semiconductor films, a p-region having a plurality of nitride semiconductor films, and an active layer interposed therebetween, a multi-film layer with two kinds of the nitride semiconductor films is formed in at least one of the n-region or the p-region,





EUROPEAN SEARCH REPORT

Application Number
EP 10 18 0069

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 9 232629 A (TOKYO SHIBAURA ELECTRIC CO) 5 September 1997 (1997-09-05) * paragraphs [0022], [0035] - [0036]; figure 3 *	1-6,14, 18,30	INV. H01L33/12 H01S5/323 H01L33/04 H01L33/32
A,P	JP 10 242512 A (TOSHIBA CORP) 11 September 1998 (1998-09-11) * abstract; figure 1 *	1-30	
A	NAKAMURA SHUJI ET AL: "InGa _N /Ga _N /AlGa _N -based laser diodes with modulation-doped strained-layer superlattices grown on an epitaxially laterally overgrown Ga _N substrate", APPLIED PHYSICS LETTERS, AIP, AMERICAN INSTITUTE OF PHYSICS, MELVILLE, NY, US, vol. 72, no. 2, 12 January 1998 (1998-01-12), pages 211-213, XP012020208, ISSN: 0003-6951 * abstract *	1-30	
A	NAKAMURA S ED - MELLOCH ET AL: "III-V nitride-based blue LDs with modulation-doped strained-layer superlattices", COMPOUND SEMICONDUCTORS 1997. PROCEEDINGS OF THE IEEE 24TH INTERNATIONAL SYMPOSIUM ON COMPOUND SEMICONDUCTORS. SAN DIEGO, CA, SEPT. 8 - 11, 1997, INSTITUTE OF PHYSICS CONFERENCE SERIES, NEW YORK : IEEE, US, vol. NR. 156, 8 September 1997 (1997-09-08), pages 1-4, XP010294538, ISBN: 0-7503-0556-8 * abstract *	1-30	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) H01L
Place of search Munich		Date of completion of the search 10 May 2012	Examiner Meacher, David
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

2
EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 10 18 0069

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 0 731 512 A (HEWLETT PACKARD CO [US]) 11 September 1996 (1996-09-11) * abstract * -----	1-30	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 May 2012	Examiner Meacher, David
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

 2
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 18 0069

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-05-2012

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 9232629	A	05-09-1997	NONE	

JP 10242512	A	11-09-1998	JP 3433038 B2	04-08-2003
			JP 10242512 A	11-09-1998

EP 0731512	A	11-09-1996	EP 0731512 A2	11-09-1996
			JP 8264833 A	11-10-1996
